

**APPLICATION FOR UNITED STATES PATENT**

**TITLE: A METHOD FOR MAKING LUBE BASESTOCKS**

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**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation-in-part of U. S. Patent Application Serial No. 10/342,600 filed January 15, 2003, which is a divisional application of U. S. Patent Application Serial No. 09/601,481 filed February 12, 1999, now U. S. Patent 6,620,312, which claims benefit of international application number PCT/US99/03007 filed February 12, 1999, which claims priority from U.S. Provisional Application No. 60/074,617 filed February 13, 1998.

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### **FIELD OF THE INVENTION**

[0002] The present invention is a method to produce high quality lube oil products involving hydrotreating a waxy feed to produce a hydrotreated feed and subsequently hydroisomerizing and hydrodewaxing the hydrotreated waxy feed.

### **BACKGROUND OF THE INVENTION**

[0003] The hydroisomerization of wax and waxy feeds to liquid products boiling in the lube oil boiling range and catalysts useful in such practice are well known in the literature. Preferred catalysts in general comprise noble Group VIII metals on halogenated refractory metal oxide support, e.g. platinum on fluorided alumina. Other useful catalysts can include noble Group VIII metals on acidic refractory metal oxide support such as silica/alumina which

has their acidity controlled by use of dopants such as yttria. As useful as hydroisomerization processes may be, in general they do not achieve the final pour point target without supplemental dewaxing, either catalytic or solvent.

[0004] Alternatively, hydrodewaxing using microporous materials is a process that can achieve low pour points, but properties such as Ciscosity Index ("VI") tended to be lower than that achieved by solvent dewaxing processes. Since the 1990's, zeolites possessing some isomerization function have been found to improve VI, but, by themselves, may not produce a basestock and/or finished oil having all the desired properties. For example, hydrotreated basestocks may have a residual haze associated with limited reaction of the highest boiling paraffins. As well, volatility may not be as low as required for a basestock of a given viscosity, associated with a reaction mechanism favoring lower molecular weight molecules in the feed. This may result in a skewed distribution of product molecules.

[0005] It is likewise known that low temperature properties are highly dependent on processing schematics and catalyst. In general, there exists a need in the art for improved catalysts and processing schemes to prepare basestocks sufficient to meet modern lubricant standards, particularly for motor

oils. Such basestocks require superior viscometric performance at both high and low temperatures as well as low volatilities.

### **SUMMARY OF THE INVENTION**

[0006] The instant invention is directed at a method for producing a lube oil lube basestock from a lube oil boiling range feedstream containing at least about 50 wt.% wax, containing at least one polar compound selected from sulfur and nitrogen compounds. The process comprises:

- a) contacting the lube oil boiling range feedstream with a hydrotreating catalyst in a first reaction stage operated under conditions effective at removing at least a portion of the at least one polar compound from said lube oil boiling range feedstream to produce a hydrotreated feed;
- b) contacting at least a portion of said hydrotreated feed with an amorphous hydroisomerization catalyst in a second reaction stage operated under effective hydroisomerization conditions to produce a second stage effluent; and
- c) contacting at least a portion of said second stage effluent with a hydrodewaxing catalyst in a third reaction stage operated under conditions effective for producing at least one lube oil basestock wherein said catalyst comprises at least one molecular sieve and an

amorphous material having at least one active metal hydrogenation component dispersed thereon.

[0007] In one embodiment, the amorphous material in the third reaction stage is selected from refractory metal oxides, refractory metal oxides including a dopant, and mesoporous catalysts, wherein the amorphous material of the dewaxing catalyst in the third reaction stage further comprises at least one active metal hydrogenation component dispersed thereon.

[0008] In another embodiment the process comprises:

- a) contacting the lube oil boiling range feedstream with a hydrotreating catalyst in a first reaction stage operated under conditions effective at removing at least a portion of the at least one polar compounds from said lube oil boiling range feedstream to produce a hydrotreated feed; and
- b) contacting at least a portion of said hydrotreated feed with a catalyst system in a second reaction stage operated under conditions effective at producing at least one lube oil boiling range basestock wherein said catalyst system comprises at least one first catalyst selected from amorphous hydroisomerization catalyst and at least one second catalyst selected from hydrodewaxing catalysts comprising at least one

molecular sieve and an amorphous materials having at least one active metal hydrogenation component dispersed thereon.

### **DETAILED DESCRIPTION OF THE INSTANT INVENTION**

[0009] The present invention is directed at a method of producing lube oil basestocks from a lube oil boiling range feedstream containing at least about 50 wt.% wax, and at least one polar compound selected from those containing sulfur or nitrogen.. In one embodiment, a hydrotreated feed is produced by contacting the lube oil boiling range feedstream with a hydrotreating catalyst in a first reaction stage operated under conditions effective at removing at least a portion of the at least one polar compound from the lube oil boiling range feedstream. At least a portion of the hydrotreated feed is subsequently contacted with a hydroisomerization catalyst in a second reaction stage to produce a second stage effluent. At least a portion of the second stage effluent is subsequently contacted with a hydrodewaxing catalyst in a third reaction stage. The hydrodewaxing catalyst comprises at least one molecular sieve and an amorphous material having at least one active metal hydrogenation component dispersed thereon.

[0010] In another embodiment of the instant invention, the second and third reaction stages appear as one reaction stage. In this embodiment, the

hydrotreated feed is conducted to a second reaction stage operated under conditions effective at producing at least one lubricating oil basestock. In the second reaction stage, the hydrotreated feed is contacted with a catalyst system comprising at least one first catalyst selected from amorphous hydroisomerization catalyst and at least one second catalyst selected from hydrodewaxing catalysts comprising at least one molecular sieve and an amorphous material having at least one active metal hydrogenation component dispersed thereon.

[0011] In yet another embodiment, the amorphous material of the hydrodewaxing catalyst is selected from refractory metal oxides, refractory metal oxides including a dopant, and mesoporous hydroisomerization catalysts, wherein the second catalyst further comprises at least one active metal hydrogenation component dispersed thereon.

[0012] Lube oil boiling range feedstream suitable for use herein contain at least about 50 wt.% wax, and at least one polar compound containing sulfur or nitrogen. These feedstreams typically have a 10% distillation point greater than 650°F (343°C), measured by ASTM D 86 or ASTM 2887, and are derived from mineral or synthetic sources. The wax content of the feedstock is at least about 50 wt.%, based on feedstock and can range up to 100 wt.% wax. The

high wax content also typically results in these feedstreams having high viscosity indexes of up to 200 or more. The wax content of a feed may be determined by nuclear magnetic resonance spectroscopy (ASTM D5292), by correlative ndM methods (ASTM D3238) or by solvent means (ASTM D3235). The waxy feeds may be derived from a number of sources such as oils derived from solvent refining processes such as raffinates, partially solvent dewaxed oils, deasphalted oils, distillates, vacuum gas oils, coker gas oils, slack waxes, foots oils and the like, Fischer-Tropsch waxes and any combinations thereof. Preferred feeds are slack waxes and Fischer-Tropsch waxes. Slack waxes are typically derived from hydrocarbon feeds by solvent or propane dewaxing. Slack waxes contain some residual oil and are typically deoiled. Foots oils are derived from deoiled slack waxes. Fischer-Tropsch waxes are prepared by the Fischer-Tropsch synthetic process.

[0013] These lube oil boiling range feedstreams can also typically contain at least one polar compound such as those containing sulfur or nitrogen, and mixtures thereof. Typically the concentration of nitrogen and sulfur polar compound are considered high by those skilled in the art. Lube oil boiling range feedstreams containing up to 0.2 wt.% of nitrogen, based on feed and up to 3.0 wt.% of sulfur can be processed in the present process. Sulfur and



nitrogen contents may be measured by standard ASTM methods D5453 and D4629, respectively.

[0014] In the practice of the present invention, the above-described lube oil boiling range feedstreams are contacted with a hydrotreating catalyst in a first reaction stage operated under conditions effective for removing at least a portion of the at least one polar compound from the lube oil boiling range feedstream to produce a hydrotreated feed. Hydrotreating catalysts suitable for use herein are those containing at least one Group VI metal and at least one Group VIII metal, and mixtures thereof. Preferred metals include nickel, tungsten, molybdenum, cobalt and mixtures thereof. These metals or mixtures of metals are typically present as oxides or sulfides on refractory metal oxide supports. The mixture of metals may also be present as bulk metal catalysts wherein the amount of metal is 30 wt.% or greater, based on catalyst. Suitable metal oxide supports include oxides such as silica, alumina, silica-aluminas or titania, preferably alumina. Preferred aluminas are porous aluminas such as gamma or eta. It should be noted that bulk catalysts typically do not include a support material, and the metals are not present as an oxide or sulfide but as the metal itself. These catalysts typically include metals within the range described above in relation to bulk catalyst and at least one extrusion agent. The amount of metals for supported hydrotreating catalysts, either individually or in

mixtures, ranges from about 0.5 to 35 wt.%, based on the catalyst. In the case of preferred mixtures of Group VIII metals with Group VI metals, the Group VIII metals are present in amounts of from 0.5 to 5 wt.%, based on catalyst and the Group VI metals are present in amounts of from 5 to 30 wt.%. The amounts of metals may be measured by atomic absorption spectroscopy, inductively coupled plasma-atomic emission spectrometry or other methods specified by ASTM for individual metals. Non-limiting examples of suitable hydrotreating catalysts include Nebula™, RT-721, KF-840, KF-848, DN 190 and Sentinel™. Preferred hydrotreating catalysts are low acidity, high metals content catalysts such as KF-848 (Akzo Nobel), DN-190 (Criterion catalysts) and RT 721 (Akzo Nobel).

[0015] As stated above, the lube oil boiling range feedstreams used herein are contacted with the above-described hydrotreating catalyst in a first reaction stage under conditions effective at removing at least a portion of at least one polar compound contained therein. By at least a portion of nitrogen polar compounds it is meant that contacting the lube oil boiling range feedstream reduces the nitrogen content to a level that will not unacceptably impact downstream, in relation to the flow of the feedstream, catalysts. The nitrogen content is typically reduced to lower than about 25 wppm, preferably lower than about 10 wppm, more preferably lower than about 5 wppm, and most

preferably lower than about 2 wppm. Likewise, by at least a portion of sulfur polar compounds it is meant that contacting the lube oil boiling range feedstream reduces the sulfur content to a level that will not unacceptably impact the downstream catalysts. The sulfur content is typically reduced to lower than about 20 wppm, preferably lower than about 10 wppm.

[0016] These hydrotreating conditions typically include temperatures of from 150 to 400°C, preferably 200 to 350°C, a hydrogen partial pressure of from 1480 to 20786 kPa (200 to 3000 psig), preferably 2859 to 13891 kPa (400 to 2000 psig), a space velocity of from 0.1 to 10 liquid hourly space velocity (LHSV), preferably 0.1 to 5 LHSV, and a hydrogen to feed ratio of from 89 to 1780 m<sup>3</sup>/m<sup>3</sup> (500 to 10000 scf/B), preferably 178 to 890 m<sup>3</sup>/m<sup>3</sup>.

[0017] At least a portion, preferably substantially all, of the hydrotreated feed from the first reaction stage is then contacted with a hydroisomerization catalyst in a second reaction stage operated under effective hydroisomerization conditions to produce a second stage effluent. Hydroisomerization catalysts suitable for use herein will typically comprise a porous refractory metal oxide support such as alumina, silica-alumina, titania, zirconia, etc. which contains an additional catalytic component selected from at least one of a Group VI B, Group VII B, Group VIII metals, preferably a Group VIII metal, more

preferably a noble Group VIII metal, most preferably platinum and palladium present in an amount in the range of 0.1 to 5 wt.%, preferably 0.1 to 2 wt.% most preferably 0.3 to 1 wt.% and which also may contain promoters and/or dopants selected from the group consisting of halogen, phosphorous, boron, yttria, rare-earth oxides and magnesia preferably halogen, yttria, magnesia, most preferably fluorine, yttria, magnesia. When halogen is used it is present in an amount in the range 0.1 to 10 wt.%, preferably 0.1 to 5 wt.%, more preferably 0.1 to 2 wt.% most preferably 0.5 to 1.5 wt.%. If the metal component is Group VIB, non-noble metal Group VIII or mixture thereof, then the amount of metal can be increased up to 30 wt.%.

[0018] For those catalysts which do not exhibit or demonstrate acidity, for example gamma-alumina, acidity can be imparted to the catalyst by use of promoters such as fluorine, which are known to impart acidity, according to techniques well known in the art. Thus, the acidity of a platinum on alumina catalyst can be very closely adjusted by controlling the amount of fluorine incorporated into the catalyst. Similarly, the catalyst particles can also comprise materials such as catalytic metal incorporated onto silica-alumina. The acidity of such a catalyst can be adjusted by careful control of the amount of silica incorporated into the silica-alumina base or by starting with a high acidity silica-alumina catalyst and reducing its acidity using mildly basic

dopants such as yttria or magnesia, as taught in U.S. Patent No. 5,254,518 (Soled, McVicker, Gates and Miseo).

[0019] Effective hydroisomerization conditions are to be considered any hydroisomerization conditions that when used in combination with the selected hydroisomerization condition operate to reduce the wax content in the lube oil boiling range feedstream to below about 40 wt.%, preferably to about 35 wt.% to about 25 wt.%. These conditions typically include temperatures between about 300°C to about 400°C, preferably about 300°C to about 380°C, pressures between about 500 to about 5000 psig (about 3.55 to about 34.5 mPa), preferably about 1000 to about 2000 psig (about 7.0 to about 13.9 mPa), hydrogen treat gas rates of 500 to about 10,000 SCF H<sub>2</sub>/B (about 89 to about 1780 m<sup>3</sup>/m<sup>3</sup>), preferably about 2,000 to about 5,000 SCF H<sub>2</sub>/B (about 356 to about 890 m<sup>3</sup>/m<sup>3</sup>), and liquid hourly space velocities ("LHSV") of about 0.5 to about 5 V/V/hr. preferably about 1 to 2 about V/V/hr, for a time sufficient to reduce the wax content in the feed to below about 40 wt.%, preferably to about 35 wt.% to about 25 wt.%.

[0020] At least a portion, preferably substantially all, of the second stage effluent is subsequently contacted with a hydrodewaxing catalyst in a third reaction stage to produce a lube oil basestock. Hydrodewaxing catalysts

suitable for use herein are those that comprise at least one molecular sieve and an amorphous material having at least one active metal hydrogenation component dispersed thereon at least one.

[0021] Molecular sieves suitable for use herein are be selected from ZSM-22, ZSM-23, ZSM-35, ZSM-48, ZSM-57, SSZ-31, SAPO-11, SAPO-31, SAPO-41, MAPO-11, ECR-42, synthetic Ferrierites, and mixtures thereof. Preferred molecular sieves include ZSM-22, ZSM-23, ZSM-35, ZSM-48, SAPO-11, and ECR-42, more preferably the dewaxing catalyst is ZSM-48.

[0022] The effective pore size as discussed above is important to the practice of the invention, not all 10 member ring molecular sieves having such effective pore sizes are advantageously usable in the practice of the present invention. Indeed, it is essential that the most preferred intermediate pore size molecular sieve catalysts used in the practice of the present invention have a very specific pore shape and size as measured by X-ray crystallography. The intracrystalline channels must be parallel and must not interconnect. Such channels are conventionally referred to as 1-D diffusion types or more shortly as 1-D pores. The classification of intrazeolite channels as 1-D, 2-D and 3-D is set forth by R. M. Barrer in Zeolites, Science and Technology, edited by F. R. Rodrigues, L. D. Rollman and C. Naccache, NATO ASI Series, 1984 which

classification is incorporated in its entirety by reference (see particularly page 75).

[0023] Upon careful examination of the intermediate pore size zeolites, however, it has been found that not all of them are efficient as a catalyst for isomerization of a paraffin-containing feedstock. The intermediate pore size zeolites forming part of the present invention are those, which in addition to having the correct pore size, are also unidirectional. Such 10 member ring, unidirectional zeolites include ZSM-22, ZSM-23, ZSM-35, ZSM-48, and materials isostructural with these as defined in *Atlas of Zeolite Structure Types* by S. M. Mier and D. H. Olson., Third Revised Edition, 1992.

[0024] The molecular sieves used herein may also be combined with a suitable porous binder or matrix material. Non-limiting examples of such materials include active and inactive materials such as clays, silica, and/or metal oxides such as alumina. Non-limiting examples of naturally occurring clays that can be composited include clays from the montmorillonite and kaolin families including the subbentonites, and the kaolins commonly known as Dixie, McNamee, Georgia, and Florida clays. Others in which the main mineral constituent is halloysite, kaolinite, dickite, nacrite, or anauxite may also be used. The clays can be used in the raw state as originally mixed or

subjected to calcination, acid treatment, or chemical modification prior to being combined with the medium pore zeolite.

[0025] The dewaxing catalyst contained in the third reaction stage also comprises at least one amorphous material having at least one active metal hydrogenation component dispersed thereon. These amorphous materials can be any of the typical amorphous materials such as those comprising a refractory metal oxide support base (e.g., alumina, silica-alumina, zirconia, titanium, etc.) on which has been deposited a catalytically active hydrogenation metal selected from at least one of Group VI B, Group VII B, Group VIII metals and mixtures thereof, preferably Group VIII, more preferably noble Group VIII, most preferably Pt or Pd. The amorphous material can optionally include a promoter or dopant such as halogen, phosphorous, boron, yttria, magnesia, etc., preferably halogen, yttria or magnesia, most preferably fluorine. The catalytically active metals are present in the range 0.1 to 5 wt.%, preferably 0.1 to 3 wt.%, more preferably 0.1 to 2 wt.%, most preferably 0.1 to 1 wt.%. The promoters and dopants are used to control the acidity of the isomerization catalyst. Thus, when the amorphous material is a base material such as alumina, acidity is imparted to the resultant catalyst by addition of a halogen, preferably fluorine. When a halogen is used, preferably fluorine, it is present in an amount in the range 0.1 to 10 wt.%, preferably 0.1 to 3 wt.%, more



preferably 0.1 to 2 wt.% most preferably 0.5 to 1.5 wt.%. Similarly, if silica-alumina is used as the amorphous material, acidity can be controlled by adjusting the ratio of silica to alumina or by adding a dopant such as yttria or magnesia which reduces the acidity of the silica-alumina base material as taught on U.S. Patent 5,254,518 (Soled, McVicker, Gates, Miseo).

[0026] The amorphous material may also be a crystalline mesoporous material belonging to the M41S class or family of catalysts. The M41S family of catalysts are crystalline mesoporous materials having high silica contents whose preparation is further described in J. Amer. Chem. Soc., 1992, 114, 10834. Examples included MCM-41, MCM-48 and MCM-50. A preferred member of this class is MCM-41 whose preparation is described in US Patent No. 5,098,684. MCM-41 is characterized by having a hexagonal crystal structure with a unidimensional arrangement of pores having a cell diameter greater than 13 Angstroms. The physical structure of MCM-41 is like a bundle of straws wherein the opening of the straws (the cell diameter of the pores) ranges from 13 to 100+ Angstroms. MCM-48 has a cubic symmetry and is described for example is U.S. Patent No. 5,198,203 whereas MCM-50 has a lamellar structure and is described in US Patent No. 5,246,689.

[0027] The catalysts contained in the first, second and third reaction stage can be placed in one or more reactors or reaction zones each of which can comprise one or more catalyst beds of the same, or a different, catalyst. Although other types of catalyst beds can be used, fixed catalyst beds are preferred.

[0028] As stated above, at least a portion of the second stage effluent is contacted with the presently described dewaxing catalyst under conditions effective for producing at least one lube oil basestock. These effective conditions typically include temperatures between about 200°C to 400°C., preferably 250° to 380°C and most preferably 300°C to 350°C, pressures between about 500 to 5000 psig, preferably about 1000 to about 2000 psig, hydrogen gas treat rate of 500 to 10,000 SCF H<sub>2</sub>/bbl, preferably 2,000 to 5,000 SCF H<sub>2</sub>/bbl, and a LHSV of 0.5 to 5 V/V/hr, preferably 1 to 2 V/V hr.

[0029] The at least one lube oil basestock produced by the process of the present invention comprises at least about 75 wt.% of iso-paraffins but has a unique structural character. Basically, the basestock has a "Free Carbon Index" (or FCI) typically lower than about 12, preferably in the range of about 4 to about 12, more preferably less than 10. The term "Free Carbon Index" is a measure of the number of carbons in an iso-paraffin that are located at least 4

carbons from a terminal carbon and more than 3 carbons away from a side chain. The FCI of an isoparaffin can be determined by measuring the percent of methylene groups in an isoparaffin sample using  $^{13}\text{C}$  NMR (400 megahertz); multiplying the resultant percentages by the calculated average carbon number of the sample determined by ASTM Test method 2502 and dividing by 100. A further criteria which differentiates these materials structurally from poly alpha olefins is the branch length. Interestingly, in the basestocks of this invention, at least 75% of the branches, as determined by NMR, are methyls and the population of ethyl, propyl and butyls, etc., fall sharply with increasing molecular weight to the point where no more than 5% are butyls. Typically the ratio of "free carbons" to end methyl is in the range of 2.5 to 4.0. Additionally, the basestocks of this invention typically have, on average, from 2.5 to 4.5 side chains per molecule.

[0030] In contrast, polyalpha-olefin (PAO) basestocks have fewer (about one) and longer branches or side chains. Indeed the ratio of "free carbons" to end methyl ranges from 1.1 to 1.7.

[0031] The FCI is further explained as follows. The basestock is analyzed by  $^{13}\text{C}$  NMR using a 400MHz spectrometer. All normal paraffins with carbon numbers greater than  $\text{C}_9$  have only five non-equivalent NMR adsorptions

corresponding to the terminal methyl carbons ( $\alpha$ ) methylenes from the second, third and fourth positions from the molecular ends ( $\beta$ ,  $\gamma$ , and  $\delta$  respectively), and the other carbon atoms along the backbone which have a common chemical shift ( $\epsilon$ ). The intensities of the  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  are equal and the intensity of the  $\epsilon$  depends on the length of the molecule. Similarly the side branches on the backbone of an iso-paraffin have unique chemical shifts and the presence of a side chain causes a unique shift at the tertiary carbon (branch point) on the backbone to which it is anchored. Further, it also perturbs the chemical sites within three carbons from this branch point imparting unique chemical shifts ( $\alpha'$ ,  $\beta'$ , and  $\gamma'$ ).

[0032] The Free Carbon Index (FCI) is then the percent of  $\epsilon$  methylenes measured from the overall carbon species in the  $^{13}\text{C}$  NMR spectra of the a basestock, divided by the average carbon Number of the basestock as calculated from ASTM method 2502, divided by 100.

[0033] Even after very low conversion levels (<10%), the value of  $\epsilon$  falls by nearly 50% and there is a large increase in the side chain fraction, larger in fact than that observed in a product that has been severely isomerized (>70% conversion to 370°C-) and solvent dewaxed. The increase in sidechains is

almost exclusively in methyl sidechains. There is a much larger percentage of terminal end groups and the distinction between a methyl at the second or third carbons from the end drops significantly. Roughly 35% of the added sidechains have been added to the last four terminal carbons.

[0034] As stated above, another embodiment of the instant invention involves combining the second and third reaction stage to form a single second reaction stage containing a catalyst system. The catalyst system of this reaction stage comprises at least one first catalyst selected from amorphous hydroisomerization catalysts and at least one second catalyst selected from hydrodewaxing catalyst comprising at least one molecular sieve and an amorphous material having at least one active metal hydrogenation component dispersed thereon. The catalyst system can be placed in one or more reactors or reaction zones each of which can comprise one or more catalyst beds of the same, or a different, catalyst. Although other types of catalyst beds can be used, fixed catalyst beds are preferred. It is more preferred that the at least one first catalyst and the at least one second catalyst of the present catalyst system be in the same reaction vessel in a stacked bed arrangement. Interstage cooling or heating between reactors or reaction zones, or between catalyst beds in the same reactor, can be employed. In this manner, optimum reaction temperatures can be more easily maintained. In this embodiment, at least a portion of the

hydrotreated feed is contacted with the catalyst system under those conditions described above as effective hydrodewaxing conditions to produce at least one lubricating oil basestock.

[0035] In one embodiment of the instant invention, the catalyst system described above is arranged in such a manner that when at least a portion of the hydrotreated feed contacts the catalyst system, it contacts the second catalyst first. In describing this embodiment, the inventors hereof find it useful to refer to the one or more fixed bed reactors or reaction zones each, which can comprise one or more catalyst beds of the first catalyst, as R1, and the one or more fixed bed reactors or reaction zones each, which can comprise one or more catalyst beds of the second catalyst, as R2. Thus, in this embodiment, the at least a portion of the hydrotreated feed would contact R2 first, thence R1.

[0036] It should be noted that the present catalyst system and process configurations provide superior performance over processes utilizing mixed, mixed powder pelletized catalysts, etc. By providing a separate hydroisomerization reaction stage and a separate hydrodewaxing stage, the practitioner is allowed to control process variables within these reaction stages to provide a process that is better suited for the particular feed processed. Thus, by placing catalysts, reaction zones, beds, etc. in the manner described

herein, the practitioner of the presently claimed process is given greater control over the reaction intended. For example, the practitioner of the instantly claimed process, if desired, could process a feedstream over the hydroisomerization catalyst for a longer period of time, under more severe conditions, etc., while not having to process the feed over the hydrodewaxing catalyst under the same conditions. However, if the hydroisomerization catalyst and the hydrodewaxing catalyst were a mixed, mixed powder pelletized catalyst, etc. the practitioner would lack this control. In particular, conditions in the hydroisomerization reactor can be tailored to control the extent of boiling range conversion of a particular feed stream to target the appropriate viscosity/volatility required for the basestock, a property not readily controlled in the hydrodewaxing reactor. For example, feeds with wider boiling range may require more severe hydroisomerization conditions to achieve sufficient conversion of the higher boiling species needed to produce a basestock with both low volatility and low viscosity. Thus, the presently claimed invention provides an advantage over processes utilizing mixed, mixed powder pelletized catalyst, etc. in that the process can be particularly tailored for any feed to provide a product in good yield with excellent viscometric properties, low volatility as well as good low temperature properties

[0037] The above description is directed to several embodiments of the present invention. Those skilled in the art will recognize that other embodiments that are equally effective could be devised for carrying out the spirit of this invention.